

## ANNUAL SUMMARY FOR 1891.

The following general discussion of the weather over the United States during 1891 is based upon seven charts, published herewith, which show respectively: I.—The annual mean atmospheric pressure and the prevailing winds. II.—The annual mean temperature and the departure from the normal temperature. III.—The maximum temperature. IV.—The minimum temperature. V.—The absolute ranges of temperature. VI.—The annual precipitation. VII.—The departure of the annual precipitation from the normal precipitation. These charts have been prepared from data received from 1,087 regular and voluntary observers of the Weather Bureau. An index of the MONTHLY WEATHER REVIEW for 1891 is also published herewith.

### ATMOSPHERIC PRESSURE.

The annual mean pressure was highest east of the Mississippi and south of the Ohio rivers, where it was above 30.10, and was lowest over the west part of the southern plateau region, where it was below 29.95. In an area extending from the Pacific coast between the 40th and 45th parallels over northern Nevada and northern Utah, and from the middle-eastern and southeastern slopes of the Rocky Mountains to the Atlantic coast south of the 42d parallel, the mean pressure was above 30.05. From the south Pacific coast over the southern plateau region and the Rio Grande Valley, and along the northern border of the country from Maine to the extreme north Pacific coast, the mean values were below 30.00.

### TEMPERATURE.

The annual mean temperature was highest in extreme southern Florida, and at stations in the lower Colorado and lower Gila valleys, where it was above 75°. It was above 70° over the Florida Peninsula, at points along the immediate Gulf coast, and in the lower Rio Grande valley, and was above 60° along the Atlantic coast south of the 36th parallel, in the east and west Gulf states, in southern New Mexico, southern and western Arizona, in southern California, and thence over the San Joaquin and Sacramento valleys. The annual mean temperature was lowest in the British Possessions north of Lake Superior, Minnesota, and North Dakota, and at elevated Rocky Mountain stations north of New Mexico, where it was below 35°. It was below 45° north of a line traced from the coast of Maine irregularly westward to eastern Wyoming, thence southward to north-central New Mexico, and thence irregularly northward to northeastern Washington. The mean values were also below 45° at stations in the Sierra Nevada Mountains between the 38th and 40th parallels, and in an area covering east-central Nevada.

### DEPARTURE FROM NORMAL TEMPERATURE.

The annual mean temperature was above the normal, except from the plateau region to the Gulf coast and the Florida Peninsula and in the interior of the Atlantic coast states south of Maryland. The greatest departure above the normal temperature was reported from the middle Saint Lawrence valley over the north part of the Lake region to the Red River of the North Valley and Manitoba, and at La Crosse, Wis., New York, N. Y., Boston, Mass., and Chatham, N. B., where it was 2°, or more, and the departure was generally more than 1° along the Pacific coast, over the Lake region, and along the immediate Atlantic coast north of Hatteras, N. C. The most marked deficiency in annual mean temperature was noted over the middle plateau region, and at Key West, Fla., where the departure below the normal exceeded 1°. A slight deficiency was reported at Portland, Me., and the annual temperature was about normal in an area extending over northern Missouri and central Illinois.

### YEARS OF HIGHEST MEAN TEMPERATURE.

At Philadelphia, Pa., the mean temperature for 1891, 55°.1,

was 0°.1 higher than the highest annual mean temperature previously reported for that station, noted for 1890, and at New York, N. Y., the mean for 1891, 53°.8, was the same as the highest annual mean, recorded for 1890. From Colorado and the southeastern slope of the Rocky Mountains over the Gulf and south Atlantic states the highest annual mean temperature occurred in 1890; from Oregon and Washington to the middle Missouri and Red River of the North valleys in 1889; from Kentucky over the middle and upper Ohio valleys, Pennsylvania, southern New York, and southern New England in 1881; and in the Lake region and the upper Mississippi and lower Missouri valleys in 1878.

### YEARS OF THE LOWEST MEAN TEMPERATURE.

At Montrose, Colo., 7 years' record, and Keeler, Cal., 6 years' record, the mean temperature was 0°.9 and 0°.4, respectively, lower than the lowest annual mean temperature previously reported. In the Gulf States, Tennessee, and the south Atlantic states the lowest annual mean temperature was noted in 1885 and 1886; from the Missouri Valley over the Ohio Valley, the Lake region, and the middle Atlantic and New England states in 1875 and 1885; from the middle-eastern slope of the Rocky Mountains over the Red River of the North Valley in 1883; and along the Pacific coast in 1880.

### MAXIMUM TEMPERATURE.

The absolute maximum temperature rose above 110° in the Sacramento, San Joaquin, Gila, and lower Colorado valleys. The highest temperature reported at a regular station of the Weather Bureau was 116°, at Yuma, Ariz., June 29th; the temperature rose to 114° at Fresno City, Cal., and Red Bluff, Cal., July 1st and August 12th, respectively; and temperature rising to 126° was reported at Pacific railroad stations in the Colorado Desert in June. At stations in the interior of the Pacific coast states from the valley of the Columbia River southward, over the west part of the southern plateau region, and in areas on the southeastern and middle-eastern slopes of the Rocky Mountains the maximum temperature was above 100°. It was above 90°, except on the extreme east and south-east New England coasts and at points in the eastern and northern Lake region; and at stations on the immediate Pacific coast north of the 38th parallel, and at Eureka, Cal., Neah Bay, Wash., and Eastport, Me., the maximum values were below 80°. At stations in the Pacific coast states south of the Columbia River the maximum temperature reported for 1891 was the highest on record, and at Port Huron, Mich., and Sandusky, Ohio, the maximum, 99° and 98°, respectively, was as high as previously noted.

### MINIMUM TEMPERATURE.

The lowest temperature of the year was noted from eastern Montana over western Minnesota in February and March, when it fell below —30°, the lowest reading at a regular station of the Weather Bureau, —35°, being registered at Moorhead, Minn., February 28th. The temperature fell below zero in middle and northern New England, eastern New York, northeastern Pennsylvania, and north of a line traced from southern Ontario west-southwest to southern New Mexico, thence northwestward to west-central Nevada, and east of this line continued northward over northeastern California, eastern Oregon, and eastern Washington. The highest minimum temperature, 53°, was noted at Key West, Fla., and the minimum values were above 32°, the freezing point, over Florida south of the 29th parallel, along the immediate west Gulf coast, and along the immediate middle and south Pacific coasts.

### TEMPERATURE RANGES.

The greatest range of temperature for the year, 131°, occurred at Fort Buford, N. Dak., and Moorhead, Minn. The range for the year exceeded 100° from eastern Oregon and eastern Washington to the western and northern Lake region

and southward over the east part of the middle plateau region and the middle-eastern slope of the Rocky Mountains, and in an area extending from Albany, N. Y., to Northfield, Vt. The least range of temperature for the year, 39°, was noted at Key West, Fla. The range was 45° at Eureka, Cal., and was less than 60° at points along the immediate Pacific coast, and at Hatteras, N. C.

#### ○ PRECIPITATION.

The greatest precipitation for the year, 121.21 inches, was reported at Neah Bay, Wash. The precipitation exceeded 70.00 along the immediate north Pacific coast. In Nova Scotia, eastern Maryland, Virginia, the south Atlantic and middle and east Gulf states, and Tennessee the yearly precipitation exceeded 50.00 inches. In the lower Colorado and Gila valleys and thence over southeastern California to Keeler the precipitation for the year was less than 5.00 inches. It was also less than 5.00 inches in adjoining parts of south-central New Mexico and extreme western Texas, and in the British Northwest Territory north of eastern Montana. The precipitation was generally less than 20.00 inches in the Rocky Mountain and plateau regions and in the Rio Grande Valley.

#### ○ DEPARTURE FROM NORMAL PRECIPITATION.

The precipitation for the year was generally deficient east of the 95th meridian. It was also deficient on the middle and south Pacific coasts and thence to the west Gulf coast. In the middle and northern districts west of the 95th meridian the precipitation was generally in excess of the average yearly amount. The most marked deficiency occurred along the immediate middle coast of the Gulf of Mexico, where it was more than 20 inches. The deficiency was more than 15 inches at Shreveport, La., and was more than 10 inches at points along the south Atlantic coast, and at Dubuque, Iowa, and Grand Haven, Mich. At stations in western Washington and western Oregon, and at Dodge City, Kans., and Saint Vincent, Minn., the excess in precipitation for the year was more than 10 inches. Small areas of excess also occurred in Tennessee, the middle Atlantic and New England states, in the Lake region, and along the Nova Scotia coast, the area of most marked excess extending from south-central Virginia to northeastern Maryland, where the precipitation for the year was 5 to 10 inches greater than the normal. An excess of 3 to 6 inches was noted along the Nova Scotia coast.

#### YEARS OF GREATEST PRECIPITATION.

At the following-named regular stations of the Weather Bureau the precipitation for 1891 was the greatest ever reported by the amounts given: Saint Vincent, Minn., 28.35 inches, 5.87 inches greater than for 1882; Denver, Colo., 21.43 inches, 1.31 inch greater than for 1876; Montrose, Colo., 11.38 inches, 1.14 inch greater than for 1885; and Roseburgh, Oregon, 46.90 inches, 1.87 inch greater than for 1879.

The greatest yearly precipitation commonly occurs on the extreme north Pacific coast, where it averages about 100 inches at Neah Bay. In 1886 the precipitation at that station was 123.23 inches, and in 1891 it was 121.21 inches. On the middle and south Pacific coasts the greatest yearly precipitation occurred in 1884, when it varied from 34.92 inches at Sacramento, Cal., and 38.82 inches at San Francisco, Cal., to 40.39 inches at Los Angeles, Cal., and 27.59 inches at San Diego, Cal. The heaviest precipitation also occurred over the south part of the plateau region in 1884, when it varied from 5.86 inches at Yuma, Ariz., to 18.30 inches at El Paso, Tex., and 23.50 inches at Fort Stanton, N. Mex. From the middle Missouri valley over the western Lake region the precipitation was greatest in 1881, the greatest amount, 56.81, being noted at Des Moines, Iowa; in the middle Mississippi and lower Ohio valleys in 1876 and 1882, the greatest amount, 75.54 inches, being measured at Little Rock, Ark., in 1882; in the lower lake region, New York, and central New England in 1878, when 60.24 inches fell at Buffalo, N. Y., and 65.53 inches at Boston, Mass.; in Maryland, the District of Columbia, and Virginia in 1889, when the amount for the year exceeded 60

inches; and on the North Carolina coast in 1877, when more than 102 inches fell at Hatteras.

#### YEARS OF LEAST PRECIPITATION.

At the following-named regular stations of the Weather Bureau the precipitation for 1891 was the least ever reported by the amounts given: Eastport, Me., 36.44 inches, 5.82 inches less than for 1889; Kitty Hawk, N. C., 42.64 inches, 2.56 inches less than for 1887; Jacksonville, Fla., 41.34 inches, 4.88 inches less than for 1889; Pensacola, Fla., 35.58 inches, 11.44 inches less than for 1890; New Orleans, La., 38.62 inches, 3.55 inches less than for 1890; Shreveport, La., 36.00 inches, 4.54 inches less than for 1890; Abilene, Tex., 17.57 inches, 1.57 inch less than for 1887; El Paso, Tex., 2.22 inches, 4.54 inches less than for 1887; Erie, Pa., 30.24 inches, 1.70 inch less than for 1888; and Chicago, Ill., 26.54 inches, 0.23 inch less than for 1886.

From the north Pacific coast to the Red River of the North Valley, in parts of Colorado and New Mexico, in the interior of the east Gulf states, and over the central Lake region the least precipitation occurred in 1889. In other sections the years of least precipitation varied. On the south Pacific coast the precipitation was least in 1881, when it was 5.00 to 6.00 inches. At Yuma, Ariz., it was least in 1880, when the total amount was but 0.74 inch. In New England the least monthly precipitation noted, 27.18 inches, occurred at Block Island, R. I., in 1888; in the middle Atlantic states, 30.21 inches at Philadelphia, Pa., in 1881; and in the south Atlantic states, 38.00 inches at Savannah, Ga., in 1881.

#### ○ NOTABLE METEOROLOGICAL FEATURES OF 1891.

The following are among the more notable meteorological features of the year:

January was unusually warm in the central and northern districts. In Montana and North Dakota the mean temperature was more than 20° above the normal, and from the Red River of the North to the north Pacific coast the month was the warmest January on record. At points in the middle Atlantic and New England states, Upper Michigan, Nebraska, southeastern Wyoming, and Texas the monthly precipitation was the greatest, and at Detroit, Mich., in Montana and eastern Washington, and at San Francisco, Cal., it was the least ever reported for January. On the 7th one person was killed, several were seriously injured, and a number of houses were destroyed by a tornado near Shiner and Yoakum, Tex. On the 31st one person was fatally hurt, several were seriously injured, and buildings were destroyed to the estimated value of \$10,000 at Palo Alto, Miss., by a tornado. The Monongahela River rose above the danger-line at Pittsburg, Pa., on the 3d, and a part of Allegheny City was flooded. At Cincinnati, Ohio, the Ohio River rose until the 6th, flooding basements at points along the river front. Vegetation was reported damaged by drought about San Diego and Santa Cruz, Cal.

In February destructive floods occurred in California, Arizona, and along the Ohio River and tributaries. At Yuma, Ariz., private property was destroyed by flood to the estimated value of over \$300,000. Along the Ohio River and tributaries large areas were flooded and immense damage was caused. The Mississippi River passed the danger-line at points south of Cairo, Ill. Floods and high water occurred in the rivers and streams of central and eastern Pennsylvania and central and eastern New York. Tornadoes were reported as follows: 9th, Helena, Ark.; damage, \$5,000. 24th, Troy, Mo.; damage, \$2,000. About midnight 24-25th, Utica, Ind.; damage, \$6,000. The lower Connecticut River was open on the 11th, and the Hudson River was open from Newburgh to New York City on the 25th.

March was unusually cold, except in extreme northeast and southeast districts and along the middle and south Pacific coasts; and from the lower Missouri valley to central Texas and thence westward to the Rocky Mountains the month was the coldest March on record. The precipitation was in excess

of the March average, except in northwest, southwest, and extreme northeast parts of the country, and at Lake Erie stations and at stations in the southeastern, north-central, and central districts the monthly precipitation was the greatest on record for March. A severe "norther" prevailed in California and Nevada on the 17-18th. Nineteen persons were drowned on the North Carolina coast, and 7 persons on the Virginia coast by shipwreck. The first boat of the season arrived at Albany, N. Y., from New York City, on the 25th. Navigation was open on the Morris Canal, New Jersey, on the 30th. On the Mississippi River navigation was open at Davenport, Iowa, on the 25th, and the river was clear of ice at Saint Paul, Minn., on the 30th. The lower Mississippi River continued high, and several crevasses were reported in the levees in Mississippi and Louisiana; no serious damage was caused. The Ohio River subsided rapidly. Damaging floods occurred along the Cumberland, Tennessee, Savannah, Little Colorado, and Sacramento rivers.

April was warmer than usual, except on the Pacific coast, and thence over the southern part of the country to Florida. On the 7th the coldest weather on record for the season prevailed over Florida. From the 3d to 7th frost injured fruit and tender vegetation in the Gulf and south Atlantic states, and in Florida as far south as Lee County and Jupiter Inlet. On the 15th a tornado visited Hansford, Tex., killing two persons, and destroying property to the value of about \$25,000. Numerous casualties by lightning were reported. The lower Mississippi River continued above the danger-line, and several breaks in the levees occurred. Navigation opened generally on the Great Lakes. Over a great part of the south Atlantic and east Gulf states and Louisiana dry weather impeded farming operations.

May was cooler than usual, except in some of the northern districts; and at points in the south Atlantic and west Gulf states, the Ohio Valley, and southwestern Arizona it was the coolest May on record. East of the Rocky Mountains the monthly precipitation was generally deficient, and over the Rocky Mountain and plateau regions and on the middle Pacific coast it was in excess of the average. On the 20th a tornado moved eastward over Boone and Audrian counties, Mo., killing 4 persons, injuring 35 or more, and destroying property to the estimated value of over \$100,000. High water in the Rio Grande River caused great destruction of property in New Mexico and western Texas, and the Pecos River was the highest ever known. The lower Mississippi River fell below the danger-line. Heavy and unusually late frosts occurred as far south as Tennessee and North Carolina.

In June the mean temperature was above the normal east of the Mississippi River. West of the Mississippi and in the extreme northeast the month was cooler than usual. Exceptionally heavy and destructive rainstorms occurred in the states of the lower Missouri valley during the second and third decades of the month, and in localities in that section serious damage was caused to crops. On the 14th a well-defined tornado visited the suburbs of Milwaukee, Wis., damaging property to the estimated value of \$4,000. On the 16th a storm with some of the characteristics of a tornado visited Bayonne, N. J. Destructive floods occurred in the states of the central valleys west of the Mississippi River.

In July the mean temperature was the lowest on record for the month from the middle-eastern Rocky Mountain slope to the Atlantic coast, and on the middle and south Pacific coasts the month was the warmest July on record. Frost occurred in New England, New York, Pennsylvania, the upper lake region, Wisconsin, Minnesota, and South Dakota, and from the Dakotas to Michigan, and in Connecticut tender vegetation was injured by frost. On the 6th 10 persons were killed and a number injured by a tornado at Baton Rouge, La., and a tornado visited southern Maryland on the 18th, seriously injuring 5 persons. Flood caused considerable damage along the Missouri River south of Pierre, S. Dak.

In August the month was warmer than usual, except in the

central valleys and along the Saint Lawrence River, and on the Pacific coast it was the warmest August on record. During the third decade of the month the temperature was the lowest ever reported for August from the Lake region and the Dakotas to the Gulf of Mexico, and heavy frost occurred from the middle and northeast slopes of the Rocky Mountains to western New York. Snow was reported in the Paradise Mountains, Nevada, on the 6th, and during the cool wave of the third decade it was noted in northwest Wisconsin, and at Buffalo, N. Y. The night of the 18th a cyclone devastated the Island of Martinique, Windward West Indies, killing about 700 persons, injuring many, and destroying property to the value of about \$10,000,000. Well-defined auroral displays were reported over the northern part of the country from New England to Washington the night of the 28-29th.

In September the mean temperature was the highest on record for the month in the north-central districts and at stations on the east New England coast. Frost occurred in the northern tier of states as far south as the Ohio and lower Missouri valleys, Colorado, and Utah, and in Oregon and north California. The first snow of the season was reported at elevated stations in the middle and northern Rocky Mountain and plateau regions during the third decade of the month, and in the mountains of Colorado a depth of 5 to 10 inches was noted. On the 11th auroras were reported from the Atlantic to the Pacific coasts and southward in the central valleys to the 40th parallel. Navigation on the middle and lower Mississippi River and tributaries was rendered difficult on account of low water.

In October the mean temperature was the highest ever reported for the month at points in Montana, Oregon, and Washington; and at stations in the south Atlantic and east Gulf states it was the coolest October on record. Heavy frost occurred as far south as southern Georgia, central Alabama, and central Louisiana, and light frost was reported in the interior of the Florida Peninsula to the 28th parallel. The monthly precipitation was the greatest ever reported for October on the middle Virginia coast, in northeast Kansas, and southern Montana, and was the least recorded for the month at stations in the Gulf states, the central Ohio valley, the upper lake region, in the Southwest, and in southern California. On the northeast slope of the Rocky Mountains and in northwest North Dakota snow fell to a depth of 10 to 15 inches, and snow fell as far south as southern Kansas, central Kentucky, and western North Carolina. Damaging drought prevailed in the Southern and Southwestern States and in parts of the Middle and Western States. Rivers and streams in the Southern States were very low, and navigation on the Ohio and Mississippi rivers was rendered difficult on account of low water.

The November temperatures were the highest ever reported for that month at stations in the plateau region and on the Pacific coast. The monthly precipitation was the heaviest ever reported for November at stations on the north Pacific coast, in the upper Missouri valley, from the central lake region over the upper Ohio valley, and in northern Arkansas and western Florida; and at points west of the lower Mississippi and lower Missouri valleys it was the least ever reported for November. Storms of exceptional severity occurred over the middle Atlantic states and the lower lake region on the 23d, resulting in loss of life and destruction of property. By the close of the month navigation in the northern rivers was generally closed for the season.

In December the mean temperature was the highest ever noted for that month from eastern New York and eastern Pennsylvania over New England; and at stations in the middle and southern plateau regions and on the middle and south Pacific coasts the month was the coolest December on record. Over the eastern part of the country the snowfall was very deficient. The weather was unusually stormy on the north Pacific coast. Navigation closed at a number of ports on the Great Lakes, and rivers in the northern tier of states were generally frozen.